

CLAIMS

What is claimed is:

1. A tunable Fabry-Perot filter, comprising:
 - 2 a pair of opposed, at least partially reflective surfaces defining an optical cavity; and
 - 4 a nano-dispersion of liquid crystals disposed in said cavity.
2. The filter according to claim 1, wherein said liquid crystals are disposed in an array in a metal-oxide matrix.
3. The filter according to claim 1, wherein said liquid crystals are disposed in an array of holes in a metal-oxide matrix.
2. The filter according to claim 1, wherein said liquid crystals are disposed in an array of holes in a metal-oxide matrix, the metal oxide being taken from the group consisting of TiO₂, SiO₂ and ZrO₂.
5. The filter according to claim 3, wherein said metal-oxide matrix is TiO₂.
6. The filter according to claim 1, wherein said liquid crystals are disposed in an irregular array of generally spherical holes in a metal-oxide matrix.

7. The filter according to claim 6, wherein said holes are on the order of about
2 10 to 50 nm in diameter.

8. The filter according to claim 6, wherein said holes make up at least fifty
2 percent of the volume of said matrix.

9. The filter according to claim 6, wherein said holes make up no more than
2 about sixty-eight percent of the volume of said matrix.

10. The filter according to claim 6, wherein said holes make up from about
2 fifty percent to about sixty-eighty percent of the volume of said matrix.

11. The filter according to claim 1, wherein said liquid crystals are in droplet
2 form, said droplets being smaller than the optical wavelengths to be passed through
the filter.

12. The filter according to claim 1, and further comprising means for applying
2 an electric field to said liquid crystals.

13. The filter according to claim 12, wherein the optical wavelengths which
2 the filter passes are tunable by varying the electric field applied across said optical
cavity.

14. A tunable Fabry-Perot filter, comprising:

2 a pair of opposed, at least partially reflective, generally parallel surfaces

defining a cavity; and

4 a nano-dispersion of liquid crystals disposed in an array in a metal-oxide
matrix in said cavity.

15. The filter according to claim 14, wherein said liquid crystals are disposed

2 in an array of substantially spherical holes in said metal-oxide matrix.

16. The filter according to claim 14, wherein said holes are on the order of

2 about 10 to 50 nm in diameter and make up from about fifty percent to about sixty-
eighty percent of the volume of said matrix.

17. The filter according to claim 15, wherein said metal-oxide matrix is

2 formed of metal oxides taken from the group consisting of TiO₂, SiO₂ and ZrO₂.

18. The filter according to claim 14, wherein said liquid crystals are in droplet

2 form, said droplets being smaller than the optical wavelengths to be passed through
the filter.

19. The filter according to claim 15, and further comprising means for

2 applying an electric field to said liquid crystals.

20. The filter according to claim 19, wherein the optical wavelengths which
2 the filter passes are tunable by varying the electric field applied across said cavity
containing said liquid crystals.

21. A method of making tunable Fabry-Perot filter, comprising the steps of:
2 providing a pair of opposed, at least partially reflective, generally parallel
surfaces;
4 positioning said at least partially reflective surfaces to define a cavity
therebetween; and
6 placing a nano-dispersion of liquid crystals disposed in an irregular array in a
metal-oxide matrix in said cavity.

22. The method according to claim 21, wherein the liquid crystals are disposed
2 in an array of substantially spherical holes in a metal-oxide matrix.

23. The method according to claim 22, wherein the holes are on the order of
2 about 10 to 50 nm in diameter and make up from about fifty percent to about sixty-
eight percent of the volume of the matrix.

24. The method according to claim 21, wherein the matrix is formed of a metal
2 oxide taken from the group consisting of TiO₂, SiO₂ and ZrO₂.

25. The method according to claim 21, wherein formation of the metal-oxide
2 matrix comprises of the steps of:
selecting a quantity of polymer balls having a predetermined size;

selecting a quantity of particles of metal oxide having a predetermined size;

2 mixing the polymer balls with the particles of titanium oxide;

placing the mixture within a form;

4 applying sufficient heat to the mixture in the form to burn off the polymer

balls and fuse the metal oxide, thereby forming a matrix of generally spherical

6 holes; and

introducing liquid crystal into the holes in the matrix.

26. The method according to claim 25, wherein the liquid crystal is introduced

2 into the matrix by means of a vacuum.

27. The method according to claim 25, wherein the metal oxide is taken from

2 the group consisting of TiO₂, SiO₂ and ZrO₂.

28. The method according to claim 21, wherein the liquid crystals are in

2 droplet form, said droplets being smaller than the optical wavelengths to be passed
through the filter.

29. The method according to claim 21, and comprising the further step of

2 providing means for applying an electric field across the cavity.

30. The method according to claim 29, wherein the optical wavelengths which

2 the filter passes are tunable by varying the electric field applied across the liquid
crystal cavity.

31. A method of using a tunable Fabry-Perot filter to selectively pass optical
2 frequencies therethrough, the filter being formed of a cavity defined by at least
partially reflective, generally parallel, spaced surfaces, with a metal-oxide matrix
4 having an irregular array of holes therein filled with liquid crystal material, the
method comprising:
6 injecting optical signals into the tunable filter; and
applying a controllable electric field across the filter to tune the resonant
8 frequency of the cavity to thereby pass optical signals having selected frequencies.

32. The method according to claim 31, wherein the resonant frequency of the
2 liquid crystal cavity is varied by changing the refractive index of the liquid crystals
therein in response to the electric field applied across the filter.